Wireless Gap Analysis

Loudoun Communications Commission report to

Loudoun Board of Supervisors

3 September, 2014

Background

- Board of Supervisors request of 3/10/2012 to Communications Commission (CC) to perform an analysis of wireless coverage gaps within Loudoun County (“GAP Analysis”)
- Study Request for Quote (RFQ) issued 9/2013
- Atlantic Group selected 11/2013
- Cross-Departmental Committee (CC, LC DIT, LCPS, LCSO, LC FREM) oversaw study work
- Started coordination with Zoning Action Group (ZOAG), voicing support for rural hamlet and ridgeline telecom Zoning Amendments (ZOAM’s)

Study Scope

- Focused on Western Loudoun County, due to limited study funding, and generally adequate state of coverage in Eastern Loudoun County
- Assessed both cellular and broadband Wireless Internet Service Providers (WISP's) wireless coverage gaps
- Primarily using theoretical topographical propagation analysis of existing and approved tower locations
- Assessed approximation of additional number of tower assets needed to provide minimally complete coverage of each type (cell vs. broadband)
  - Not their locations

Strategic Context of Wireless

- Existing County video franchise cable providers (Verizon, Comcast) are the only providers of wired broadband to public
- Limited service availability in the West
- Current franchise agreements have varying and disputed obligations for build-out, but lack specific performance remedies or penalties sufficient to warrant the investment needed to complete build out throughout the West
- Therefore, wireless is essential for broadband in the West
- Poor cell coverage in West is also a public safety issue
- Both are strategic economic development issues for the County

Study Vendor Presentation

- By George Condyles
  President
  Atlantic Group

Loudoun County, Virginia

Wireless Broadband

"Gap Analysis"
for
Wireless Facilities
2014

THE ATLANTIC GROUP
OF COMPANIES, INC.

April 17, 2014

Scope

- PURPOSE

The purpose of this Project is to:

–Conduct an initial "high-level" study of cellular and mobile broadband (3G & 4G) coverage gaps in the territory of Loudoun County.

The primary focus of this study should be:

–Western, more rural, half of the County with the primary objective focusing on:

- major coverage gaps
- commuting rush-hours along arterial and feeder roadways that pose a public safety hazard.

Process

- Using data supplied by The Atlantic Group and Loudoun County.
  - **Loudoun County: 2002 Master Wireless Telecommunications Plan**
  - **Loudoun County: 2007 Update of the 2002 Master Wireless Telecommunications Plan**
  - **Loudoun County Geographic Information System – (GIS)**
  - **Loudoun On-Line Land Applications –(LOLA)**
- Consider scenarios based on various tower heights (AGLs):
  - 195 ft., 120 ft. & 80 ft.
- Consider tower needs based on two basic technologies and their propagation traits:
  - **Technology #1 (Mobile Broadband) =Example: Verizon, AT&T, T-Mobile, Sprint etc.**
    - **Cellular (LTE/4G) (900 MHz & 1.9 -2.1 GHZ) (Verizon – HomeFusion)**
  - **Technology #2 (Fixed Broadband) = WISP : Point-Multi-Point**
    - **WISP (Wireless Internet Service Provider) Broadband spectrum**
    - **2.4 and 2.5 GHz**
    - **4.9 and 5.8 GHz**

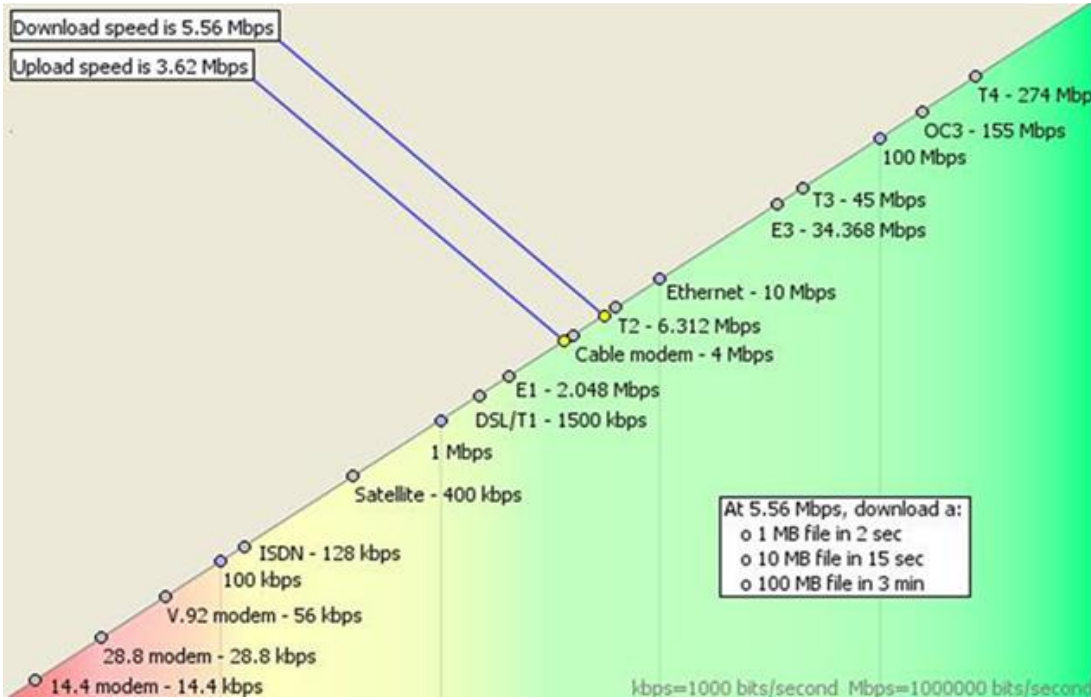
What Lane and Speed are your Cruising in the Information Super highway?

- **Right Lane ?**
  - Recreational traveler?
  - E-mails, Text, Skype, Movies, YouTube etc. ?
  - Speed : 1 Mbps to 4 Mbps

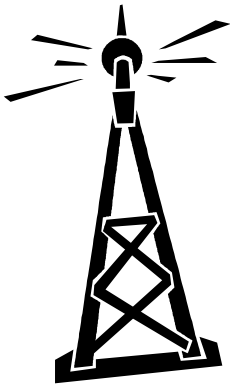
- **Center Lane ?**
  - Distance Learning?
  - Telemedicine?
  - Home-based business ?
  - Telecommuter?
  - Speed: 4 Mbps to 10 Mbps

- **Fast Lane ?**
  - Heavy data user with applications?
  - Telecommuter- IT ?
  - Commerce and Investment?
  - Speed: 10 Mbps +

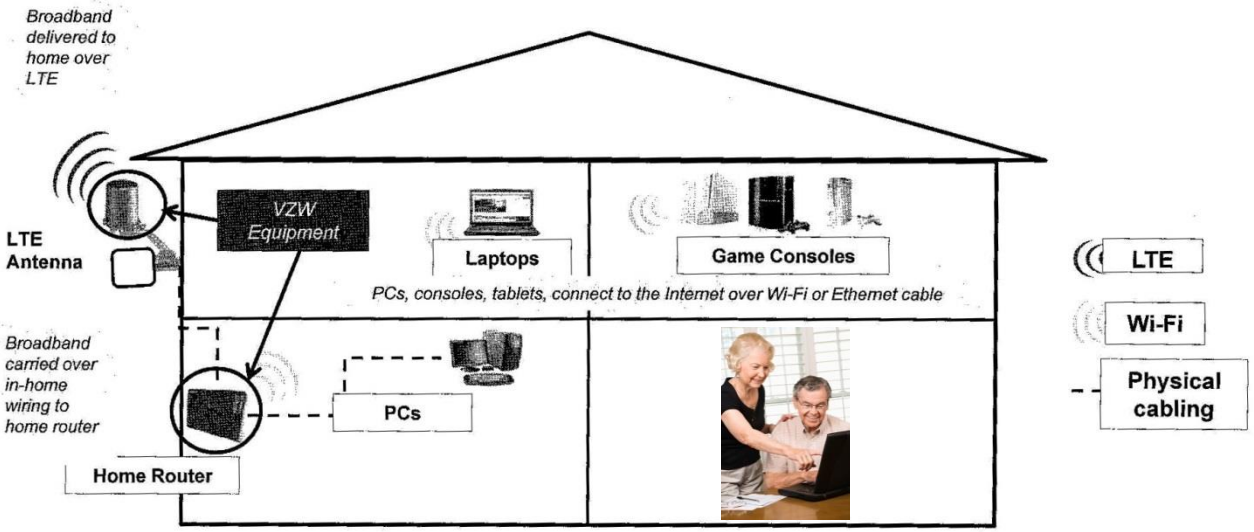
What Speed are you willing to pay for?



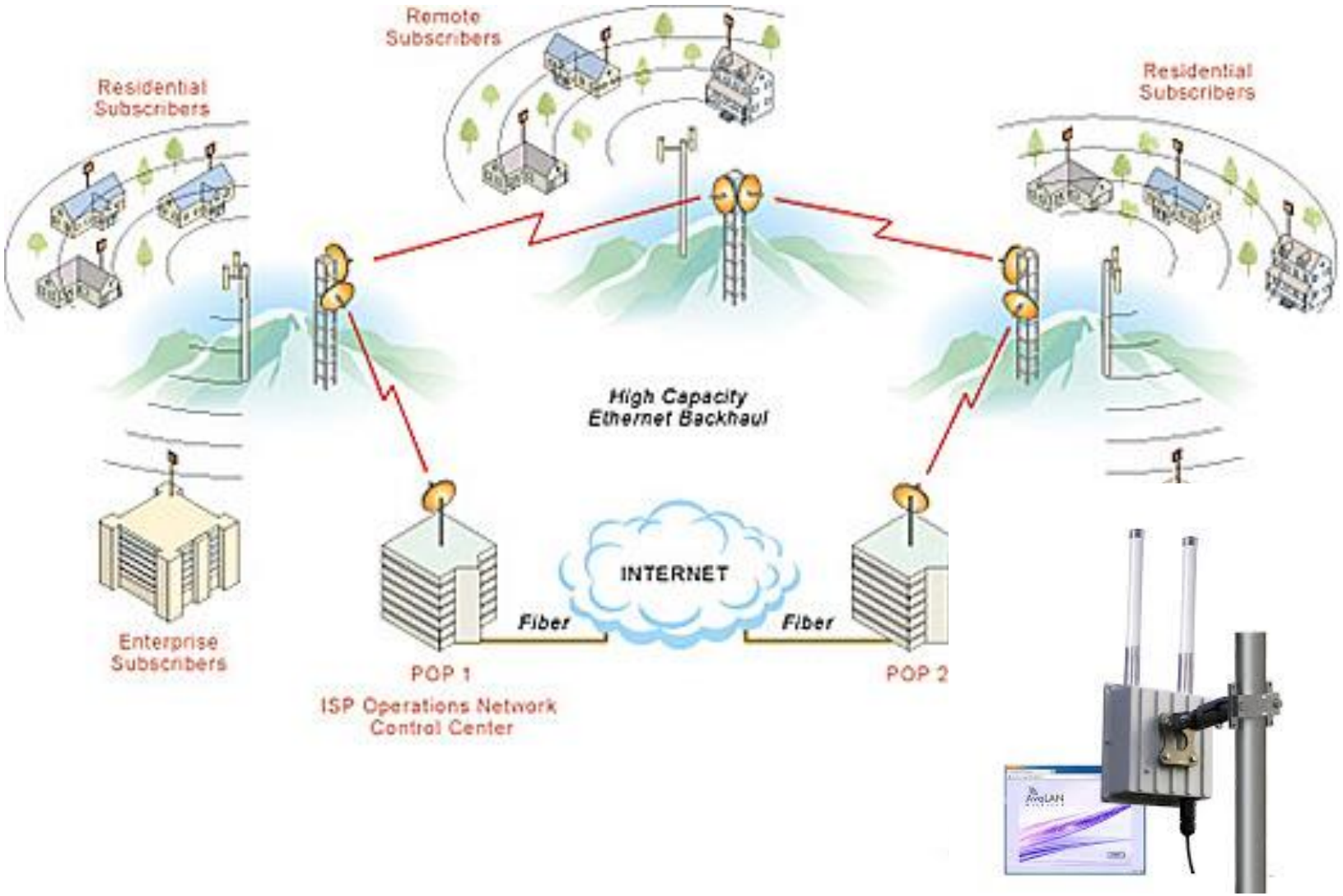
Technology #1 : Mobile Broadband: Example – Verizon "HomeFusion" Service



HomeFusion



Technology #2 – WISP-Point to Multi-Point: Private Service Providers

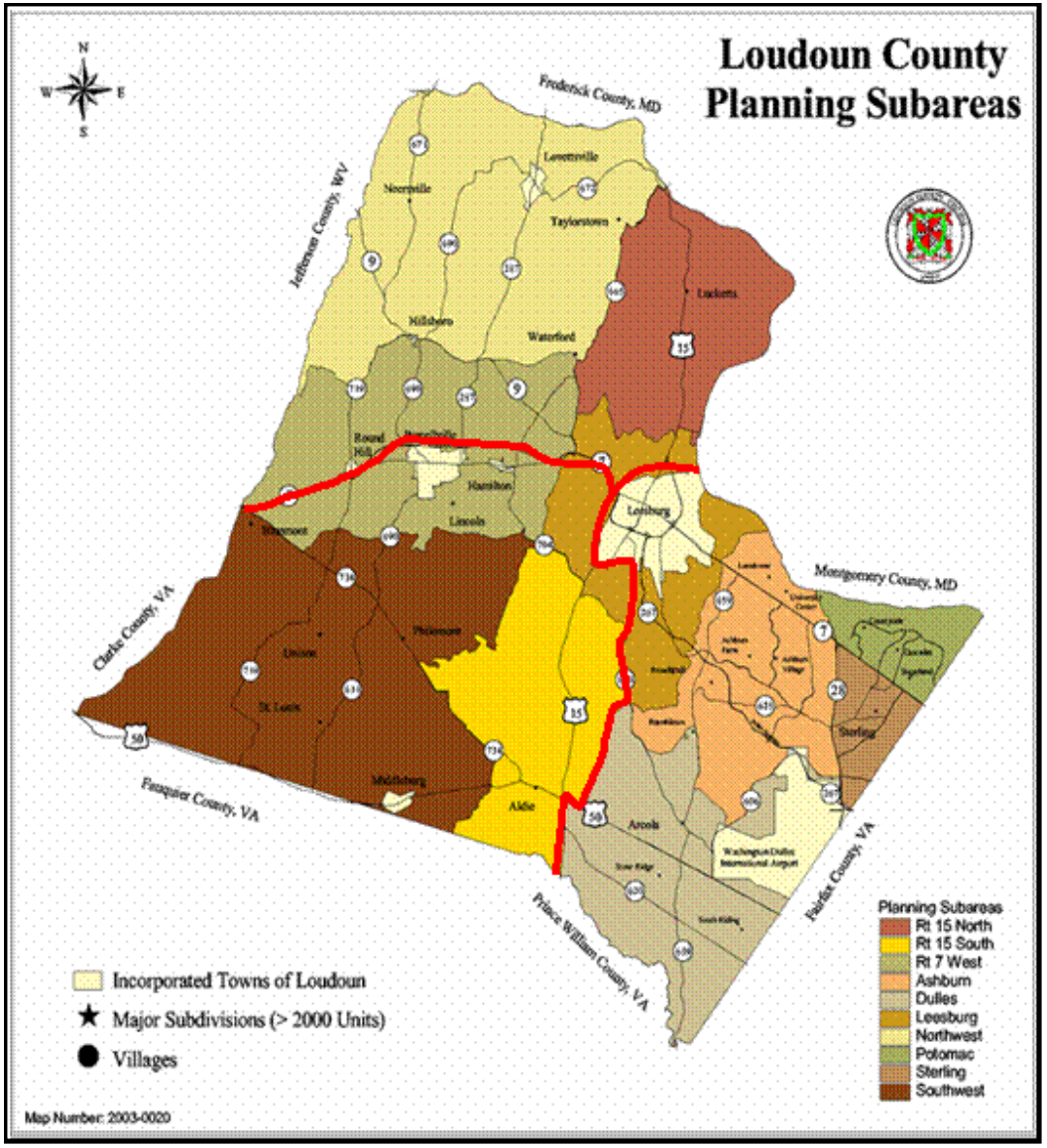


Geography

County divided into

Three (3) geographic areas of Loudoun

- **"Northern" Region**
  - **Rt. 7 and North of Leesburg**
- **"Southern" Region**
  - **Rt. 7 and West of Rt. 621**
- **"Eastern" Region**
  - **Leesburg and East of Rt. 621**



2007 Vertical Assets Inventory

Mostly centered around central & eastern Loudoun

40…..Communications Towers
10…..Water Tanks
15…..Power Mounts
  1… Silo
  2… Wooden Poles
  4…. Stealth Technology
10…..Roof Tops
11…..Outside County Towers with Loudoun Influence

-Total of potential of 146 “Slots” to Co-locate in Inventory

Sites "Approved" Since 2007

(Note: Not all Sites have been built)

SITE ID	APPLICANT	COMMUNIITY	ADDRESS	TYPE	AGL-ft.
LOU-044	CWS	Taylorstown	13514 Springhollow Ln.	Monopole	150
LOU-111	Verizon	Roundhill	17144 Evening Star Drive	Water Tank	120
LOU-045	CWS	Waterford	38295 Charles Town Pike	Monopole	110
LOU-046	AT&T	Middleburg	21164 Steptoe Hill Road	Monopole	120
LOU-047	Cingular/AT&T	Middleburg	35396 Millville Road	Monopole-Tree	115
LOU-048	Invs. Tower	Purcellville	36623 Heskett Lane	Monopole-Tree	120
LOU-049	AT&T	Hamilton	39098 Irene Road	Monopole	110
LOU-050	T-Mobile	Leesburg	18756 Harmony Church Road	Monopole	75
LOU-610	Sprint/Nextel	Leesburg	Gleedsville Road	Rootop	110

Summary (Source LOLA)

- 9 – Commission Permit (CPMT) Approvals since 2007
  - 7 Towers
    - 5 – monopoles
    - 2- Stealth Trees

    Average Height : 115’ AGL
  - 2 Structures
    - 1 Water Tank
    - 1 Rooftop
- Several in Community Development Stage
  - Not all built as of this Study

Estimated Cost of Wireless Communications Facilities

- Planning Phase
  - Engineering, Survey & Site Plan, NEPA & Section 106, FAA & FCC
  - Legal
  - Marketing and Administrative
  - Total Cost……..$100,000
- Approval Phase
  - Submission, Advertising, Community Meetings, Public Hearings
  - Total Cost……..…$35,000
- Construction Phase
  - Permitting, Site Prep, Construction (Steel/Concrete), Power, Telco
  - Total Cost (195')……..$125,000
  - (150')……$100,000
  - (120')……..$85,000
  - (100')……..$75,000
  - (80')…….$65,000
- Completion Phase
  - Total Cost.....$25,000

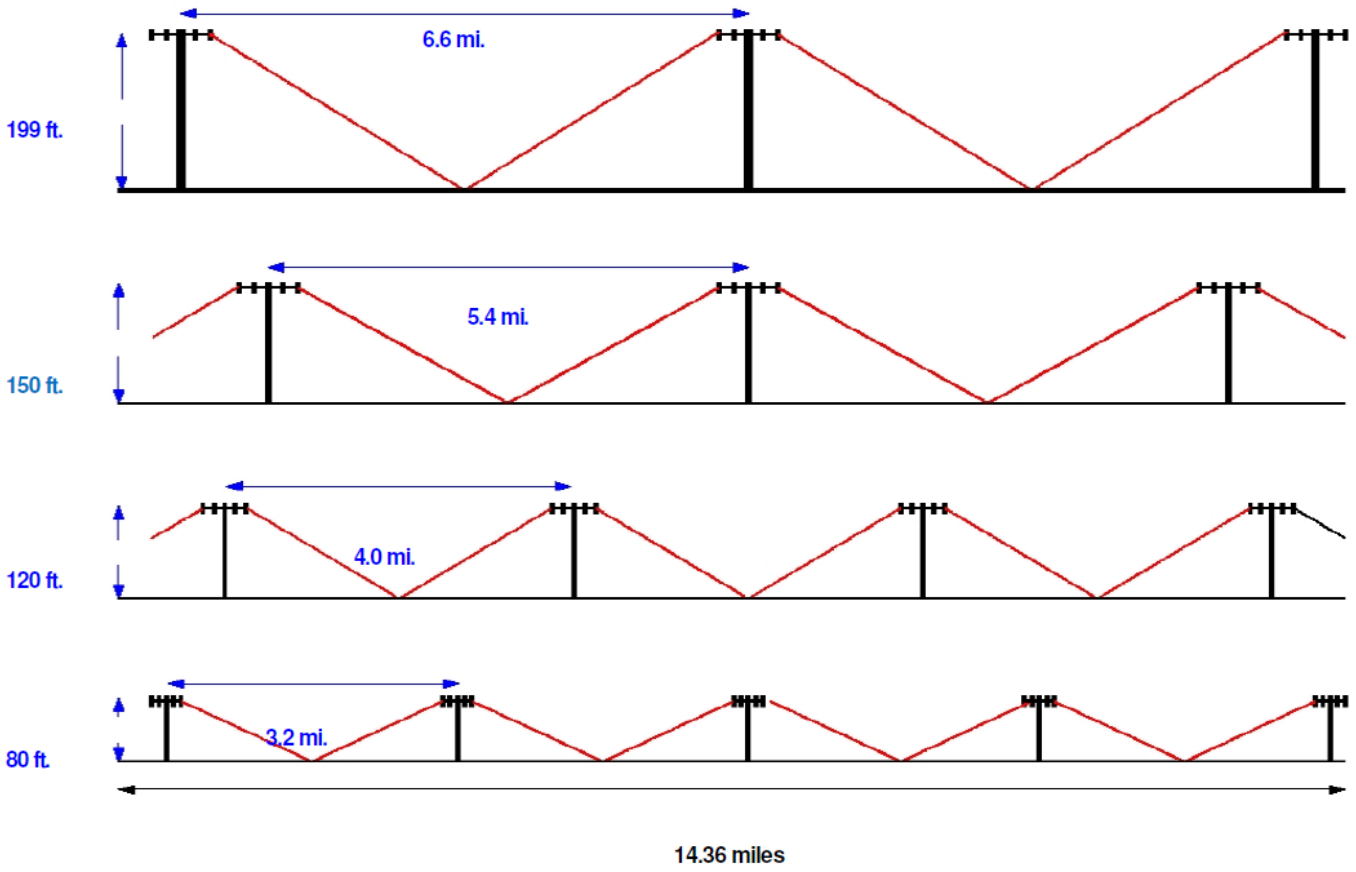
- Estimated Total Cost……..$225,000 -$300,000

- Stealth Technology……..Add Approx. 35%

What is a Successful Wireless Broadband "Connection" ?

- "Down-Link" and "Up-Link" equal is transmission strength and reliability.
- Capacity to handle "Average Rate of Bits of Information".
- Minimum "Interference" of objects and radio frequencies.
- Reliable Equipment

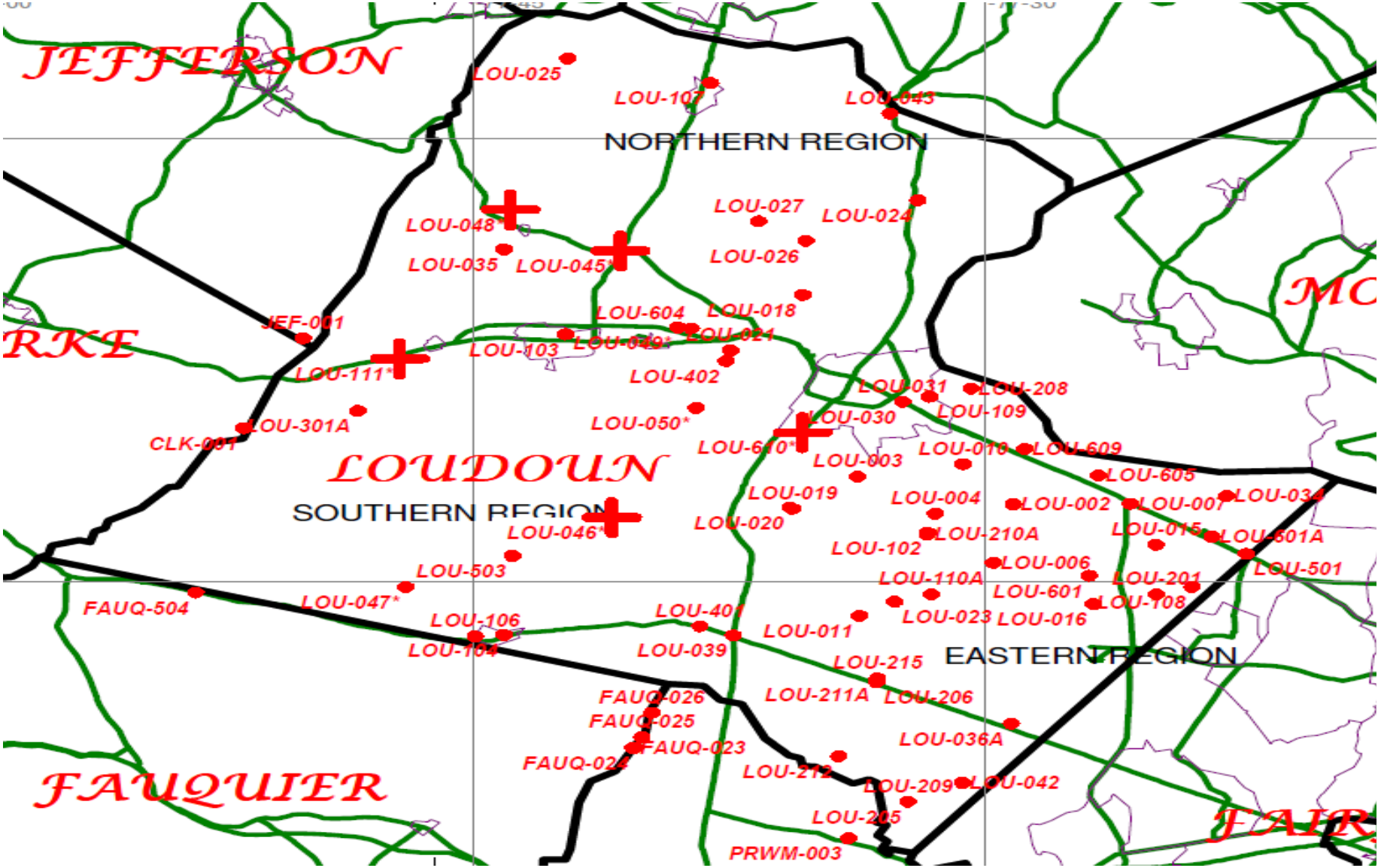
"Rule of Thumb of Tower Distances –LTE Service"



Rule to Remember:

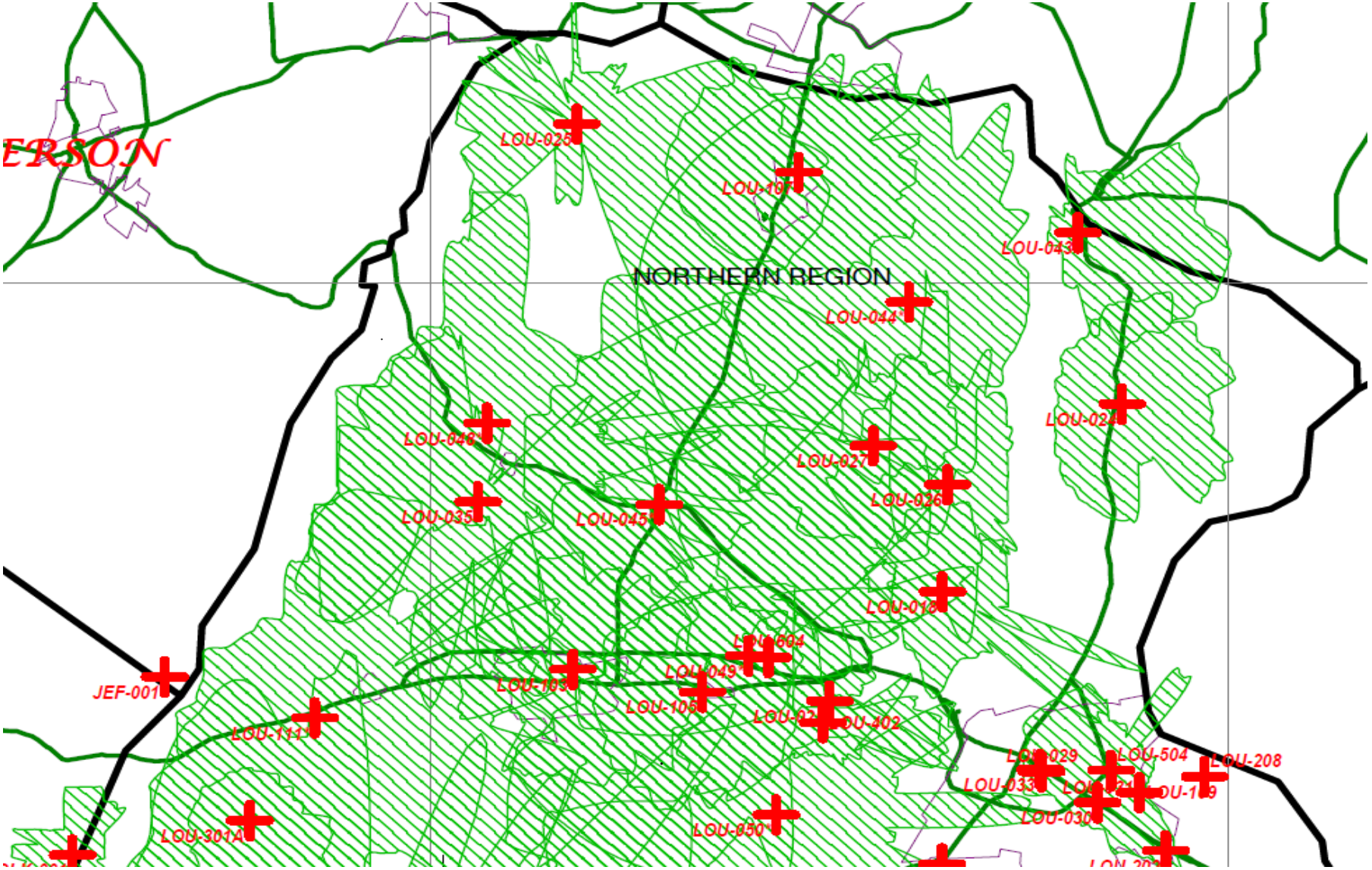
Height and distance are but only two (2) pieces of data required to estimate coverage of service areas. Characteristics such as antenna "Gain", Transmission Line "Loss", Curvature of the earth, foliage, location of PDA, antenna patterns, antenna tilt, jumper line loss, Amplifiers, weather, etc are all part of the calculation of a coverage "prediction". In all there are 23 pieces of data that must be input to have a successful estimate on coverage.

2014 – All Tower Sites

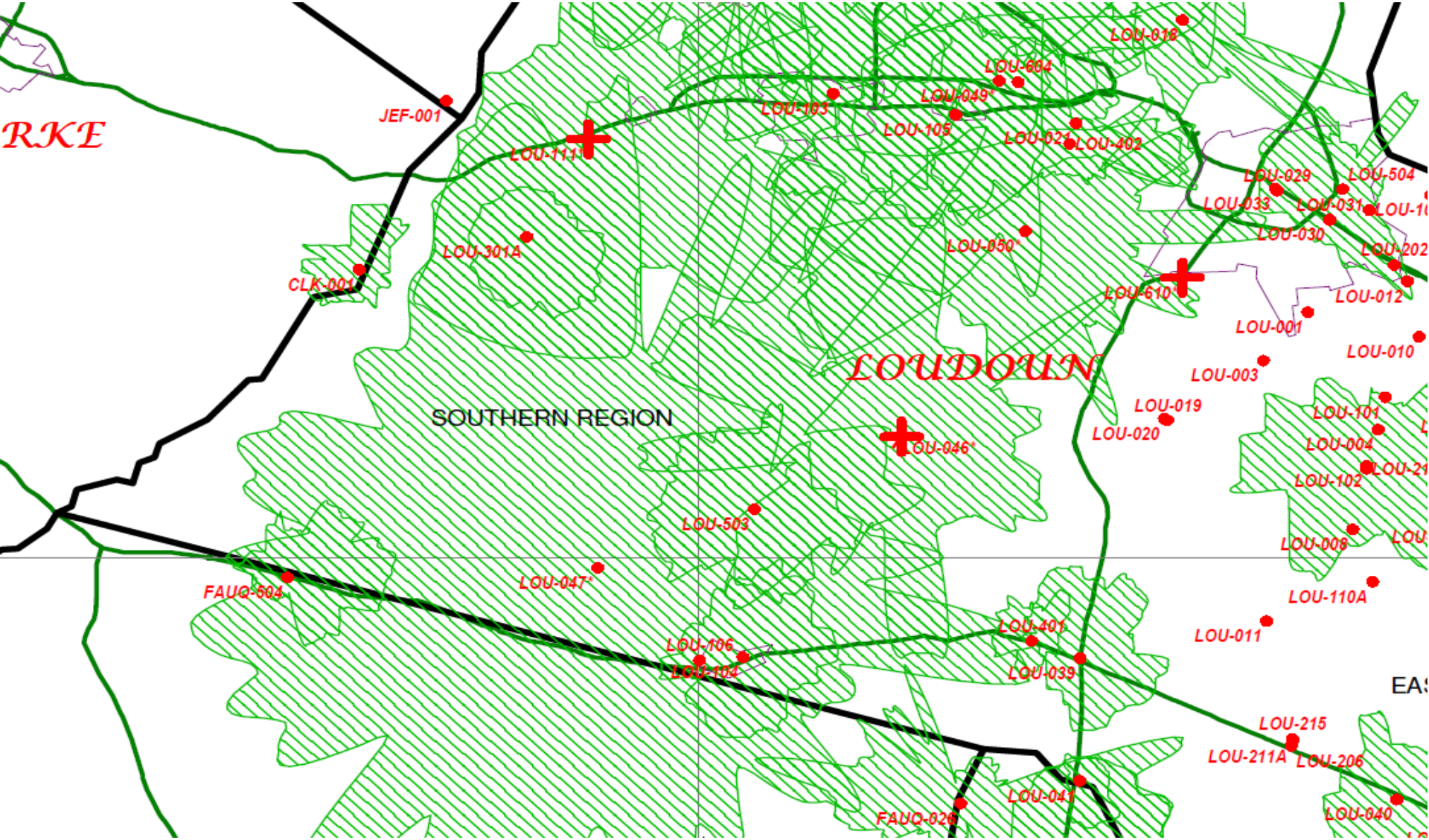


“Theoretical” Northern Region – Cell: LTE/4-G

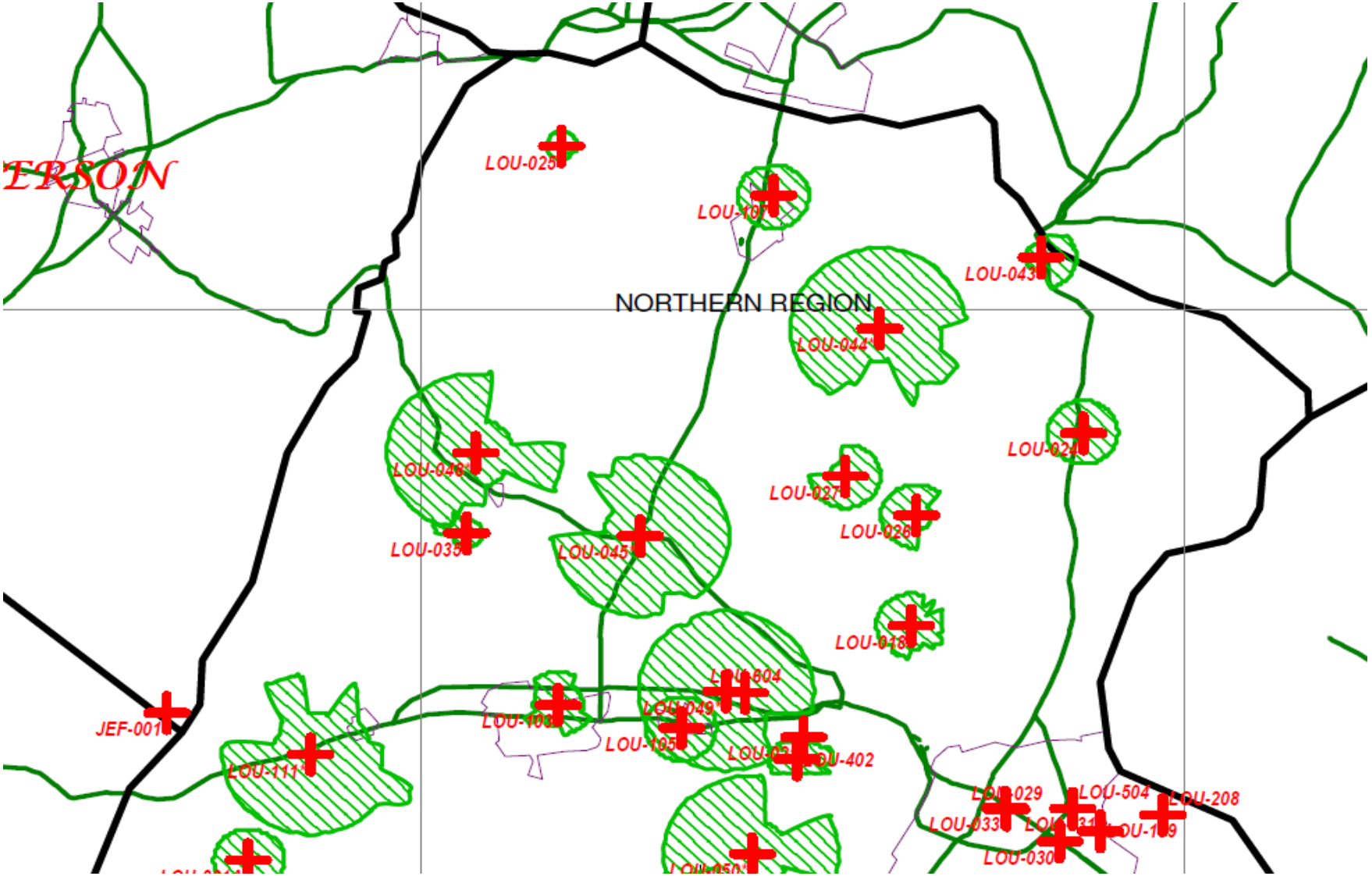
(Theoretical: If all carriers co-located on each tower)



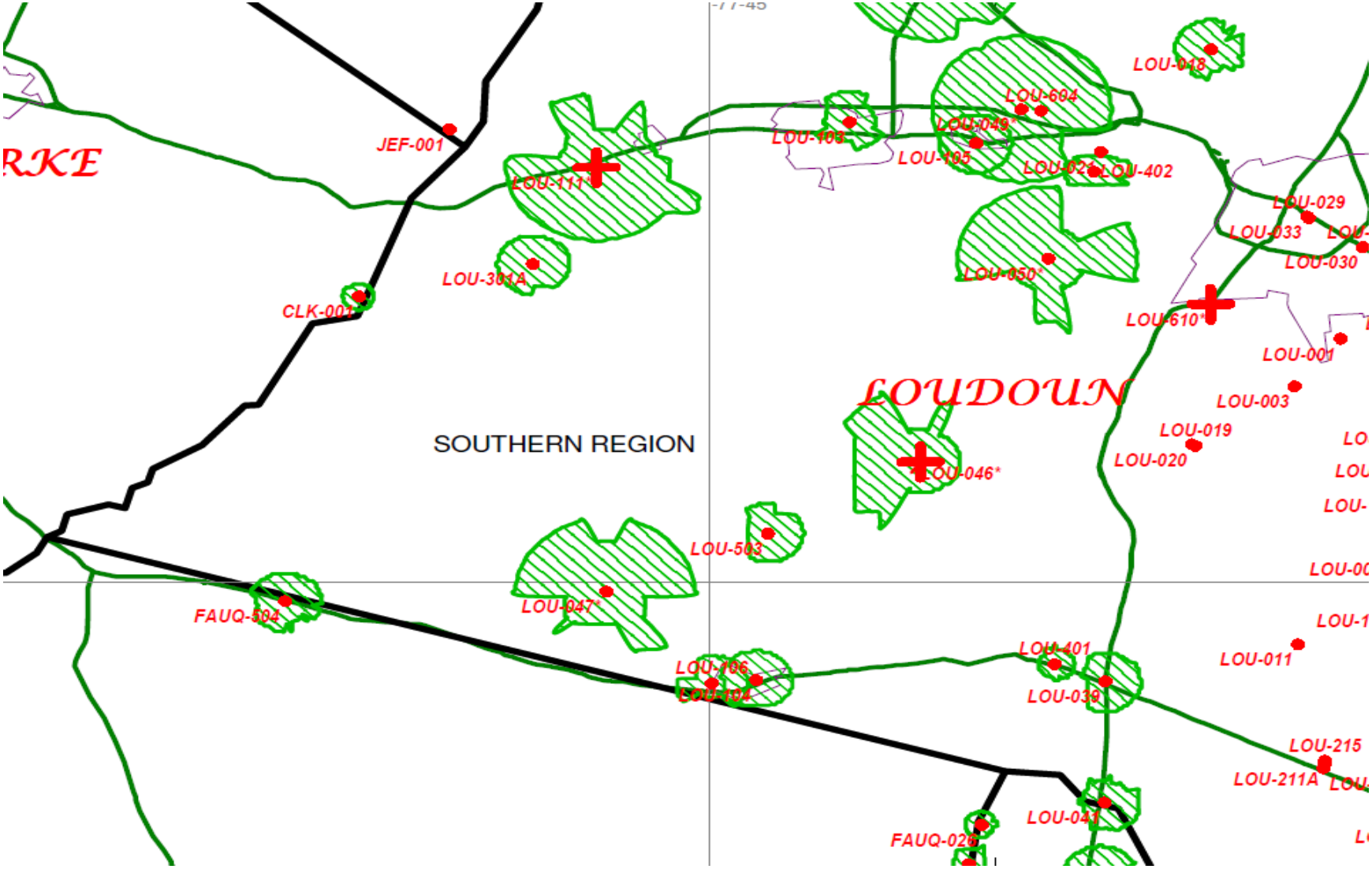
“Theoretical” Southern Region – Cell : LTE/4-G



"Theoretical" Northern Region - WISP



"Theoretical" Southern Sector - WISP



Estimated Towers by Region

FORECAST OF TOWERS
BY AREA BY HEIGHT BY TECHNOLOGY

Technology	Tower Height-Feet	Northern Loudoun					Southern Loudoun					Eastern Loudoun				
		195	150	120	100	80	195	150	120	100	80	195	150	120	100	80
	Cellular : LTE/4-G	2	3	4	5	6	7	10	10	18	21	3	3	3	3	5
	Fixed Wireless 900 MHz	6	8	10	14	16	10	14	18	24	28	3	4	5	7	8
	Fixed Wireless 2.4 and 2.5 GHz WISP	7	10	14	18	20	12	17	22	30	34	3	5	6	8	10
	Fixed Wireless 4.9 and 5.8 GHz WISP	7	11	14	20	22	12	18	23	33	37	3	5	6	9	10

Total Countywide

Estimate Per Region : # per height/region

Notes:

These are estimates for various carriers to co-locate on vacant slots on the structure.

Non-Cellular un-licensed providers must coordinate radio frequency deployment not to interfere with another un-licensed carrier.

All technologies can co-locate on each tower, however there must be tower planning for this.

Examples of Low Profile Towers

80’ AGL
Monopole

100’ Stealth Silo
Battle
of the Wilderness
National Park

120’ AGL Stealth Tree
at
Mount Vernon National Park

Consultant's Recommendations

1. Consider hosting a *Broadband Summit* for service providers in the County annually.

   Invite Wire and Wireless Service Providers, County Economic Development, Planning, IT, Education Departments & the PUBLIC.

   (Broadband Council to host)

   Discuss

   1. Roadblocks to Service Delivery
   2. Goals and Objectives of Service Providers
   3. County "assistance" in Broadband Deployment

2. Modify Planning and Zoning Ordinance to Allow "By-Right" communications Facilities (Administrative Review) for 80' AGL or less pending meeting all Zoning and Planning requirements pre-established. Greater than 80' AGL, follows existing Procedural path.

3. All sites greater than 80' but less than 120' must be deployed using "stealth" technology in Scenic and Historical areas as defined by the County, COVA and EPA/DoI/NPS.

4. Use of County owned property. (Parks, Convenience Centers, Surplus land etc.)

5. Consider Dept. of Public Works/Utilities to provide assistance of placement of wooden poles on Utility Right of Ways for fee for WISP providers.

Communications Commission Conclusions

- Tower propagation analysis confirms generally poor wireless coverage in West
- Cell coverage:
  - Green areas in maps on slides20 & 21 show coverage by any *one* cell carrier, not *all* carriers.
  - Approx. ~1/3 of towers are independently owned and accessible to more than one cell carrier
  - Roughly, only one quarter of Western Loudoun covered adequately by any *one* cell carrier
  - Major commuter corridors (e.g. Rt. 7 Clarks Gap) spotty
- **Need 14-28 new cell towers**, assuming 120 ft. AGL
  - By comparison, in last 7 years only 9 towers approved (1.3/yr.)
- Capital investment of $5-10M just for towers
  - Not including backhaul (fiber or wireless infrastructure to connect tower to carrier networks), RF equipment on tower, power, etc.

Conclusions (cont.)

- Broadband/WISP coverage, needed as alternate broadband technology, unavailable to most of West
  - Cellular internet alternatives not generally adequate for broadband (e.g. data caps)
- **Need 36 (120 ft.) – 59 (80 ft.) towers** for WISP coverage in West
- Capital investment ~$3.6-5M (poles only)
- Insufficient County vertical assets in West to provide most of these sites
- Number of tower facilities needed is based on minimum topographical coverage projections and not based on subscriber and spectrum density demands, which could and will likely be higher over time

Commission Recommendations

- County adopt pro-wireless infrastructure policies, e.g.:
  - By-Right ZOAM for 80’ AGL or less meeting prescribed min requirements
  - Expedited process for 80-120’ AGL stealth poles
  - ZOAM to enable consideration in PDH, Hamlet, and Mountain Overlay
  - Designate Permitted Commercial Tower Development Areas (PCTDA) for zoning and planning purposes
  - Policy preference for tower applications conforming to open (shared) access requirements
- Encouragement of development of shared infrastructure
  - Communications Commission preparing recommendations for public private partnership (PPP) options to facilitate